Why, by the way, our Continental friends call this range "the Russian chain" is not quite apparent. Russia is still a long way off, and Japan has rendered it improbable that Russian earth-hunger will ever be able to extend the dominion of the White Tsar, as was once hoped by his subjects, to the borders of Tibet. The "Yellow Tsar," the "Bogdo-khan" in Peking, still rules the lands which his ancestors held two thousand years before St. Petersburg was built, and that his subjects are worthy to administer this dominion is evident from what Dr. Stein tells us of the civilised rule of the Chinese, and of the constant friendliness of the Imperial authorities to his mission and their keen interest in his archæological discoveries. The thanks of Western science are due to the Chinese for their ever-ready help to Dr. Stein, without which his discoveries would have been impossible to achieve.

NEW HIGH VACUUM PUMP.

NO laboratory, either chemical or physical, can be carried on to-day without a vacuum pump of some form or other, and in many laboratories it is essential that the pump shall be capable of producing the very highest degree of evacuation. Not only is it necessary to be able to produce a high vacuum, but it is also eminently desirable that it should be possible to produce the state of evacuation as rapidly as possible.

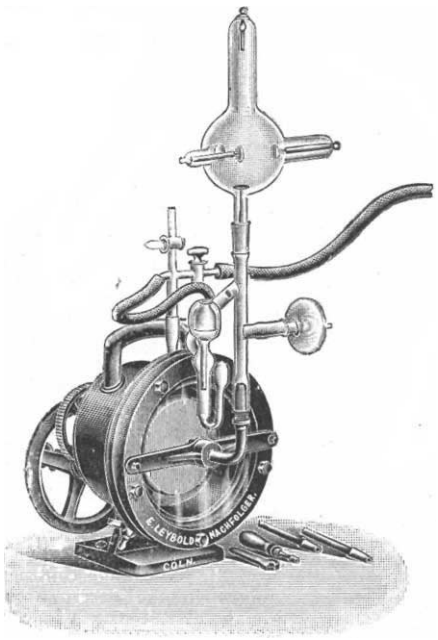

FIG. 1.

The new high vacuum pump of Dr. Graede, manufactured by E. Leybold's Nachfolger, Cologne, would appear to meet these desiderata. It is claimed that with this pump the highest vacua yet obtainable are secured in a minimum of time. The pump is also simple and compact, and may either be mechanically or hand driven.

The pump which is illustrated in Fig. 1 consists of an iron vessel, half filled with mercury, in which a porcelain drum divided into three chambers rotates. When the drum is rotated the chambers into which it is subdivided are filled alternately with air and mercury. In the first place the chambers suck the air from the receiver, and during further rotation the air is expelled and its place taken by mercury. Fig. 2 shows a section of the pump, one-fourth the actual size. G is the cast-iron casing, which is glazed inside and is cast on to a strong base. The front of the pump consists of a thick plate of glass cemented into the frame P. It is then screwed tightly on to the frame against rubber rings, in order to make an air-tight joint. Three holes are bored into the glass plate, by means of which the two tubes R and R′ and the tap at the bottom are attached. The tube R is connected by means of the glass apparatus, Fig. 3, with the receiver, and R′ with a second pump which serves for preliminary exhaustion. The tap is for introducing mercury into the pump and also for emptying it. The auxiliary pump may be a water injector or any other suitable form of pump which is capable of giving a vacuum of from 15 to 20 mm. T is the porcelain drum which is attached to the axle A, passing through the casing by means of an air-tight joint, to which is attached the driving wheel.

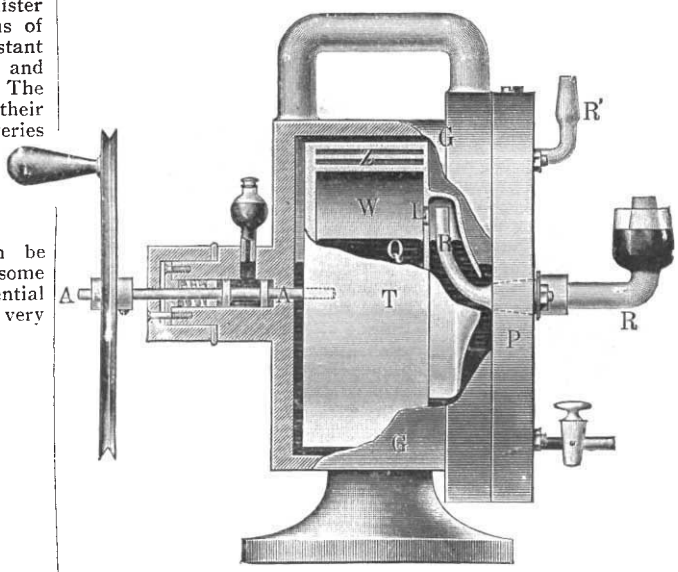

FIG. 2.

In using the pump, exhaustion up to 15 to 20 mm. is first produced by means of the auxiliary pump; the drum is then slowly rotated in a direction contrary to the hands of a clock. The space W thus increases in size and air is sucked through the opening L. As rotation is continued the opening L passes below the level of the

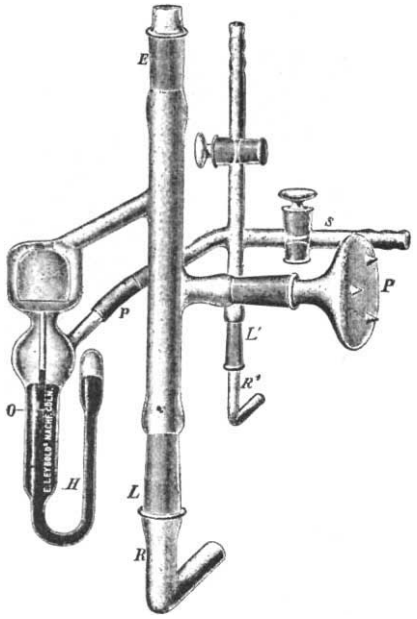

FIG. 3.

mercury, and the air in the chamber is no longer in connection with the receiver. But as the drum contains three chambers, one of them is always above the mercury; hence the action is continuous. As the chamber revolves W becomes more and more immersed in the mercury, and the air is forced out through the channels Z into the space between the drum and casing, from whence it is removed by the auxiliary pump.

Fig. 3 illustrates the glass attachment, which can be fitted on to the tubes R and R′, Fig. 2, by means of the ground pieces L and L_1. The receiver to be exhausted is attached at E. A manometer H, with a drying chamber P filled with phosphorus pentoxide, is employed to measure the pressure. It also serves as an automatic valve; at atmospheric pressure the orifice O is open; therefore the auxiliary pump connected at S exhausts the receiver fitted at E, directly through the opening O and the connecting tube P. On a vacuum of 20 mm. being attained, the mercury sinks in the right-hand limb, and, rising on the left, closes the opening O as illustrated in the figure; the mercury pump is then started.

Figures are supplied showing the extreme vacuum which can be obtained in a few minutes. Thus in five minutes the MacLeod gauge registered only 0·027 mm., and after fifteen minutes 0·000003 mm. This shows that the pump works extremely rapidly and very efficiently. If it is capable of doing all that is claimed for it, the Gaede pump should prove of great value either for research work or for showing lecture experiments with high vacua.

THE CAUSE OF EARTHQUAKES.

AMONG the results produced by the San Francisco earthquake of April 18, 1906, must be reckoned a memoir, by Prof. T. J. J. See, covering 140 pages of the Proceedings of the American Philosophical Society (vol. xlv., October–December, 1906), on the cause of earthquakes, mountain formation, and kindred phenomena. The explanation adopted is a development of an old-fashioned idea, and is supported by quotations from the writings of natural philosophers from Aristotle down to Charles Darwin. Earthquakes, with volcanoes and mountain ranges, are all ascribed to the explosive power of steam formed within or just beneath the heated rocks of the earth's crust, chiefly by the leakage of sea water through the ocean beds; the pressure of this steam forces the lava in a lateral direction, and its subsequent condensation leads to the subsidence of the sea bottom often observed after great earthquakes; the lava forced aside may either break out through volcanic vents or may lift the overlying rocks into mountain ranges, and, when the movement is sudden, give rise to faults and fractures which are the result, not the cause, of earthquakes.

It is round these last words, italicised by Prof. See, that criticism naturally centres, and the first consideration which arises is the verbal one of what is an earthquake and what is a cause. An earthquake, as ordinarily understood, is a shaking of the earth, and this shaking is due, wholly in the great majority of cases, and very largely in the remainder, to the molecular movements involved in the transmission of elastic wave motion. In the case of great earthquakes, fractures of the solid rock, accompanied by more or less displacement of the opposite sides of the fissure, are often found, and as the shaking of the earth is greatest near these, and the disturbance is propagated outwards from them, they have been regarded as the cause of earthquakes. In other cases, where no actual fissure is observed at the surface, there is good reason to suppose that the earthquake was caused by an underground fracture, which did not reach the surface, and there can be no doubt that this explanation is adequate in almost, if not quite, every case; but even if the fracture is the immediate cause of the disturbance which is commonly known as an earthquake, the explanation is still incomplete, for we have not reached the cause of the fracture.

It is to this ultimate cause that Prof. See appears to apply the term earthquake, and he is probably right in rejecting the tectonic hypothesis either in the form in which it presents itself to him or in the more ordinary one which regards the fractures as the result of compressional strains, largely due to the secular contraction of the earth, but his explanation fails to account for the remarkable connection between the irregular shifting of the earth's axis and the occurrence of great earthquakes. That these irregular movements of the axis are greatest when large earthquakes are most frequent is a certain, but as yet unexplained, fact; it seems to necessitate displacements of matter in the earth on a far larger scale than is indicated by the differential measurements which alone are open to us. Prof. See's explanation, though it provides for lateral and vertical displacements of matter, necessitates the elevations and depressions being so closely contiguous as practically to neutralise each other's effects, and, therefore, fails as an explanation of the ultimate cause of earthquakes, while it in no way affects the current acceptance of fracture as their immediate cause.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LEEDS.—The retirement of Prof. Miall, F.R.S., from the chair of biology, which he has occupied in the Yorkshire College, and subsequently in the University of Leeds, since the year 1876, was recently made the occasion for expressing in a tangible way the esteem and regard in which he is held by his colleagues and friends. A testimonial committee, of which the Vice-Chancellor (Dr. Bodington) was chairman, was formed, and a ready response was obtained to the circular inviting subscriptions for this purpose. Among the testimonials to Prof. Miall which have been thus provided is a portrait by Mr. Frederick Yates, intended to be hung in the hall of the University. The presentation of this portrait was made at a recent meeting in the University library, when a large number of his colleagues and friends were present. The Vice-Chancellor, who presided and made the presentation, spoke in warm and feeling terms of the eminent services which Prof. Miall had rendered to the college and University, as well as to the cause of science, and described him as having been original as a teacher, eminent as a scientific worker, and active as a business colleague. Subsequent speakers included Mr. S. P. Unwin, Dr. Eddison (emeritus professor of the University), and Prof. Smithells. Prof. Miall, in acknowledging the presentation, gave a short historical sketch of the foundation of the Yorkshire College of Science and its development into the Yorkshire College and subsequently into the University of Leeds.

The chair of biology will in future be divided into the professorships of zoology and of botany. To the former has been appointed Dr. Walter Garstang. Prof. Garstang has held research fellowships in zoology at Owens College, Manchester, and subsequently at Lincoln College, Oxford, where he has filled various appointments as lecturer and examiner. He is at present chief naturalist to the Marine Biological Association in charge of the Lowestoft Laboratory.

To the chair of botany Mr. V. H. Blackman has been appointed. Prof. Blackman was sometime fellow of St. John's College; he has held an assistantship in the British Museum, having charge of the collection of fungi, and he is at present engaged in botanical teaching, being a recognised teacher of that subject in the University of London.

In connection with the new department of fuel and metallurgy under Prof. Bone, F.R.S., the Institute of Gas Engineers has established a research fellowship of the value of 100*l.* a year.

The extensions of the University buildings upon which the council is at present engaged comprise:—(1) an extension of the main building in College Road for the better accommodation of biology and of arts teaching; (2) an extension of the civil and mechanical engineering department; (3) the erection of a detached block for the department of electrical engineering; (4) an extension of the cloth finishing department; (5) the completion of the block of buildings for the mining and metallurgical departments. The last-mentioned block will be ready for occupation by the students at the beginning of next session, in October. In addition to these buildings, the University is